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ABSTRACT

A study was undertaken to assess the efficacy of the spaced lecture as a possible alternative to the traditional lecture method. The spaced lecture separates note-taking from intensive listening. Two hundred male and female freshman and sophomore students at a junior college in Georgia in fall 1978, in intact classes, were administered three main effects: note-taking versus no note-taking; outline provided versus no outline; and spaced lecture versus traditional lecture. Four dependent variables were derived: immediate recall, delayed retention, high importance material, and low importance material. Findings reveal, after statistical analysis of the results, that either note-taking or an outline is essential to recall, regardless of material presentation by the teacher. It appeared that note-taking and outline serve as processing strategies. Several areas for further study are suggested: notes as external storage for further memory; effects of fast speech rate in lecturing; length of the space in spaced lecture; length of the lecture itself; number of lecture segments; nature of the outline; effects of student attitude; video or live lecture; concept versus fact learning; and high versus low ability and note-taking. It is suggested that the present study did not completely settle the question of the value of notes themselves, although they did not interfere with recall and did aid in external processing. It appears that "passive" listening to lectures does not produce superior learning. (MSE)

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TESTING THE SPACED LECTURE FOR THE COLLEGE CLASSROOM

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TESTING THE SPACED LECTURE

FOR THE COLLEGE CLASSROOM

It seems logical that when students must listen to and later recall the content of a college lecture they should take notes. Note taking, on the surface, would appear to assist in the internal processing of information and to serve also as an external memory aid.

As innocuous as note taking seems to be, this activity has been a subject of controversy particularly during the 1970's when many researchers began to question the value of notes in expository teaching. Investigation began in the 1920's when H. E. Jones (1923) found no evidence that note taking was beneficial for either immediate or delayed memory. In 1925, C. C. Crawford said, "There is in many quarters a conviction that undivided attention to a lecture is superior to writing notes and later studying them" (p. 282). In 1951, Kurt Lewin, although not concerned with classroom note taking, hinted at the controversy when he said, "It is often observed that making a written note of an intention is conducive to forgetting it" (p. 111). But, he also observed that there are cases where note taking facilitates remembering even if the notes are not seen again.

Lewin's observations were clearly in keeping with what researchers have labeled the encoding function of notes or the internal processing of information versus the function of notes as external storage, or the keeping of notes to be studied at a later time.

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After some investigation in the 1920's, the topic was ignored for a considerable period of time. Inquiry was virtually non-existent in the 1960's possibly because of that decade's general desire for systems of individualized instruction and a move away from expository teaching toward a more humanistic and less autoritarian approach to higher education. Then, in the 1970's, a weak interest in the effects of note taking was revived and the controversy began again. In the note taking literature, one finds highly contradictory results. Some researchers have concluded that note taking is not beneficial and may actually interfere with the internal processing of information. Others have found notes serving the encoding function, the external storage function or a combination of the two enhancing the learner's performance. Since there are so many potential variables involved in any investigation of note taking, it is easy to see why the results are highly contradictory. These variables have been clearly pointed out in the note taking literature.

In 1975, E. G. Aiken, G. S. Thomas, and W. A. Shennum introduced a new idea for expository teaching. They thought that perhaps the simultaneous listening and transcribing of notes may indeed interfere with the encoding process. Therefore, they hypothesized that periods of silence between lecture segments might help solve this problem. They called their innovation the spaced lecture. Here's how it worked. The lecturer breaks the material down into segments. For example, lecture for ten minutes. During this time, students listen only and do not take notes. Then, during a period of silence, students write down what they learned. Then the lecture resumes again followed by another period of silence during which notes are taken. This format might also help in solving the problem of a lecturer who "talks too fast." Thus, another of their hypotheses was that

the divided attention problem would be amplified by increasing the density of information and by speeding the rate of presentation. The Aiken, Thomas, and Shennum subjects were fulfilling a course requirement for introductory psychology at a westerm university. There were 180 subjects in 18 experimental groups comprising a 3 x 3 x 2 between subjects factorial design. Intact groups were used. Both of their hypotheses were confirmed. Separating note taking from listening by means of a spaced lecture format produced superior learning. High information density and a speeded presentation of 240 words-per-minute almost always produced deleterious main effects upon recall.

Although the spaced lecture format sounded like more of the massed-practice versus distributed-practice issue which long ago appeared to have been settled, we were intrigued by the idea and decided to check it out since, as of 1978, no one else had done any further studies of it. The purpose of our experiment was to test the efficacy of the spaced lecture as a possible alternative to the traditional method of lecturing. A Secondary purpose was to determine the relative usefulness of note taking to see if there were any negative effects and also to see if a topic outline of the lecture material was of any value.

Our subjects were 200 male and female freshmen and sophomore students enrolled in regular, intact classes at a junior college in North Georgia during the fall quarter, 1978. Their ages ranged from 18 to 42. A 2 x 2 x 2 multivariate analysis of covariance with four dependent variables was employed. The three main effects were: notes versus no notes, outline versus no outline, and the spaced lecture versus the traditional lecture. Intact classes served as experimental groups and analysis of covariance was used to remove variance due to academic ability as

measured by standardized tests. The Scholastic Aptitude Test score, both verbal and quantitative was used as the covariate.

Four dependent variables were derived from a scoring procedure for immediate recall of lecture material and a delayed retention test one week later. For both immediate recall and delayed retention, there was a score for material of "high importance" and a score for material of "low importance" resulting in four dependent variables. Relative importance of material was determined by 41 student judges prior to the experiment. These judges, of course, did not take part in the experiment. There were 25 subjects in each of eight cells.

A 20-minute audio lecture was adapted from a biographical account of the life of Thomas Henry Huxley (Clark, 1968) and his descendents and was recorded and reproduced on high quality equipment by a male lecturer. The stimulus material was chosen because it was not likely that the subjects would be familiar with it, but would have some related knowledge to which to anchor new information. The lecture was recorded at approximately 120 words-per-minute and presented at a comfortable listening level.

The traditional lecture had no pause of silence and was intended to simulate the usual classroom lecture procedure. The spaced lecture was the same material recorded in two 10-minute segments, each followed by two minutes of silence for note taking. There were four traditional lecture conditions and four spaced lecture conditions. In the traditional lecture condition, subjects either took notes as they listened, looked at an outline and took notes as they listened, looked at an outline and took no notes as they listened, or just listened.

In the spaced lecture conditions, subjects either took notes during the two 2-minute segments, looked at an outline without taking

notes during the two 2-minute segments, took notes and looked at an outline during the two 2-minute segments, or took no notes, looked at no outline, and performed a symbol transfer exercise during the two 2-minute silent segments. The symbol transfer exercise (see page 10) was constructed similar to the Digit Symbol sub-test on the Wechsler Adult Intelligence scale. The purpose of the exercise was to prevent covert rehearsal of lecture material during the two minutes of silence. Subjects were not told of the purpose of the exercise at the time of treatment, but an explanation was given after the delayed retention test.

Since students in intact classes were the experimental subjects, the classes were randomly assigned to treatment conditions. Groups were run during day classes only and no 8:00 a.m. classes were used. Subjects were advised by their respective instructors of their participation the day before their group was to be run and they were informed that participation would would not adversely effect their grade. There was a request, but no requirement to participate and no extra credit was given. The overlap of subjects who had already participated in a group were dismissed. Responses of members of groups that had more than the required 25 subjects were randomly removed before scoring began.

Subjects were required to recall in writing, without benefit of notes or outline, the information from the lecture. Free recall was used for the memory test. There was a test immediately after the lecture and another, unannounced, exactly one week later. Nothing was said to the subjects about the impending delayed retention test, and subjects in notes conditions did not have a chance to view their notes.

Subjects were asked to remain in the experimental room when they had finished writing and were requested not to talk or look at other

material. They were also encouraged to continue writing as long as they could. There were no restrictions on spelling, grammar, or sentence structure. All groups' instructions were uniform and there was no time limit. Time alloted was adequate and was tested before the actual experiment was run.

Four retention scores were derived for each of the 200 subjects. Sentences judged to be of high importance received a score of two, while sentences judged to be of low importance received a score of one for each immediate recall and delayed retention. A three-way multivariate analysis of covariance was used to analyze the data. (Table 1) Wilk's Lambda Criterion with Rao's Approximate F Statistic was used to test the multivariate null hypothesis. The three experimental factors were Notes, Outline, and Type of Lecture. Of major interest in the study was the testing of the efficacy of a spaced lecture versus the traditional lecture. Statistical significance was achieved in both the outline and notes conditions, but contrary to the Aiken et. al. findings and our expectations, there was no significant difference between the two types of lectures.

One first order interaction (Table 2 and Figure 1 and 2) and the three-way interaction achieved significance at the .001 and .012 levels respectively. Post-hoc measures for the differences between means were tested at the .01 level. Briefly, data analysis indicated that either the taking of notes or the possession of a topic outline was advantageous to the subjects in terms of producing higher recall of lecture content (Tables 3 and 4).

Notes should be taken if there is no outline, regardless of the type of lecture. In no instance did a no-notes condition lead to superior results when an outline was not available. In addition, the

taking of notes did not have deleterious effects. It appears, then, that taking notes or possessing an outline serve as processing strategies. It should be mentioned, here, that this investigation was concerned only with the encoding function and notes did assist encoding. The utility of notes for external storage was not investigated.

At first glance, it begins to sound like there was an "either-or" situation regarding notes and outlines. Therefore, a caution is necessary here. Artifacts of the experiment possibly led to this appearance. That question could not be settled within the design of this experiment and the question of "either-or" or both remains unanswered.

The results and limitations of this investigation suggested many areas for further study of note taking. As of the completion of this experiment, there are only two known tests of the spaced lecture. The idea may still show itself to be advantageous. In summary, then, there are several areas which may be fruitful for further investigation of note taking and its relationship to the spaced lecture versus a traditional lecture. Those areas include notes as external storage for further study and rehearsal, the effects of fast speech rate, the length of the "space" in the lecture, the length of the lecture itself, the number of lecture segments, and the nature of the outline. In addition, the question of either notes or an outline remains to be investigated along with the effects of student attitude, video or live lecture, concept learning versus factual learning, and the differential effects of note taking for students of high and low ability. The majority of subjects for this investigation had SAT scores below 550 for each verbal and quantitative measures (Table 5). There was no affective measure in this experiment.

The present investigation did not completely settle the question of whether notes are advantageous or detrimental to the student, but notes did not interfere with recall or retention and did aid in internal processing. Analysis suggested that, except for delayed retention of what judges considered to be information of low importance, notes were significantly advantageous regardless of the lecture type when a topic outline of the lecture material was not provided for the subjects. Simply, it appeared that a topic outline aided recall and retention even if notes were not taken, but if there was no outline to accompany a lecture, notes aided in recall and retention.

Again, a lecturer should not assume the "easy way out"; that by suggesting a student take notes, the preparation of an outline is not necessary. That question was not settled. The value of an outline with notes must not be readily dismissed.

Given these results, it would appear that so-called "passive" listening to a lecture does not produce superior learning. Some activity such as note taking while listening or looking at an outline while listening may be advantageous for learners.

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SYMBOL TRANSFER EXERCISE

For No Notes/No Outline/Speced Lecture Condition

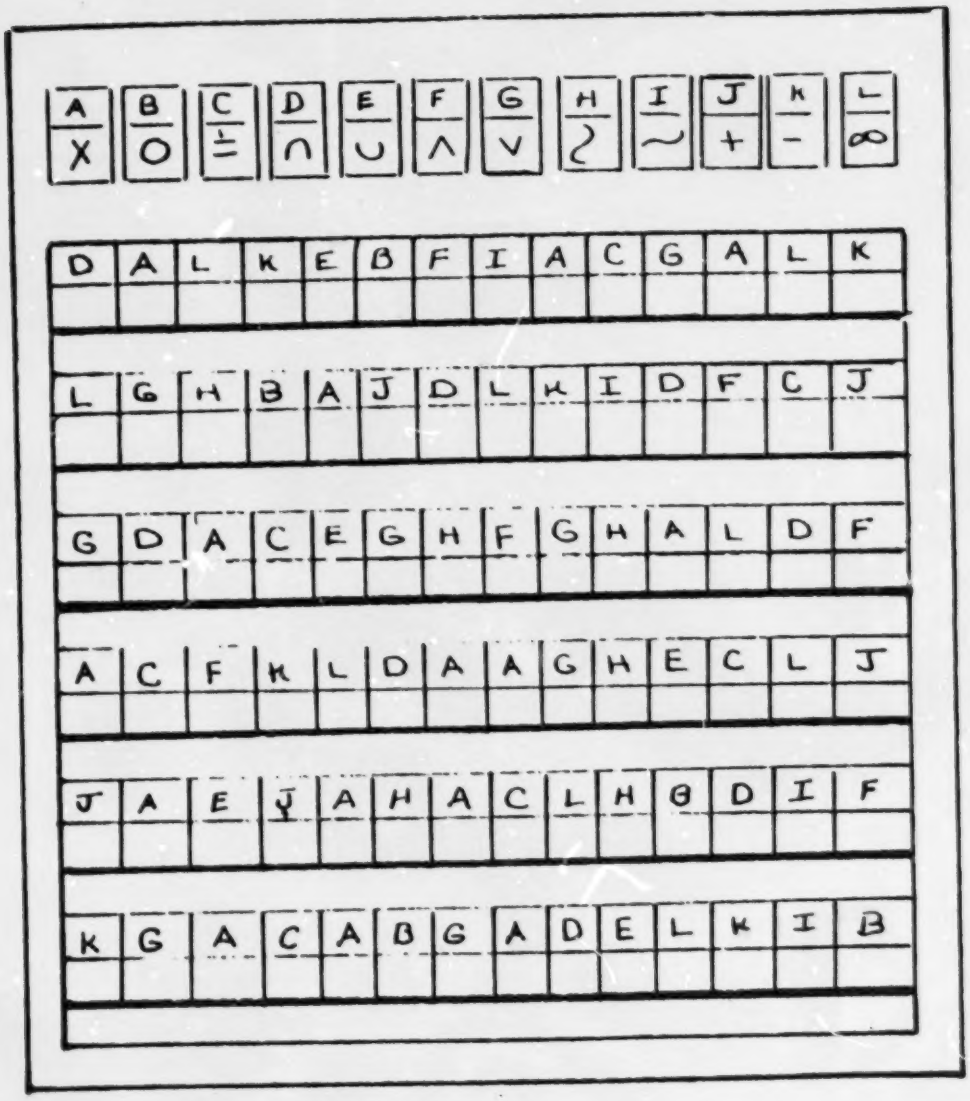

Table 1

Three-Way MANCOVA--Four Dependent Variables

Rao's Approximate F Statistic

Source of Variation	F-Ratio	df	Probability
N	9.41	4/187	.001
O	5.24	4/187	.001
L	1.74	4/187	.141
N x O	6.88	4/187	.001
N x L	1.94	4/187	.200
O x L	1.30	4/187	.268
N x L x O	3.29	4/187	.012

Table 2

Means and Standard Deviations for Interactions

Four Dependent Variables

Treatment Conditions	Dependent Variables							
	Immed. Recall High		Immed. Recall Low		Del. Ret. High		Del. Ret. Low	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
SL, N, O	25.16	12.32	22.48	8.53	18.00	9.83	5.96	3.06
SL, N, NO	36.32	14.39	30.32	10.16	25.60	11.41	10.48	5.59
SL, NN, O	26.04	13.10	25.92	8.66	17.44	9.60	8.80	6.04
SL, NN, NO	18.32	12.94	12.32	8.49	11.20	8.38	6.72	4.31
TL, N, O	25.96	12.01	26.56	10.28	23.44	9.24	6.12	3.70
TL, N, NO	32.36	11.47	25.36	10.54	21.04	8.62	10.60	4.51
TL, NN, O	21.24	10.40	22.88	8.28	15.76	8.55	5.48	3.19
TL, NN, NO	17.68	10.44	18.32	10.01	12.64	8.22	5.04	3.55

SL = Spaced Lecture
TL = Traditional Lecture
N = Notes
NN = No Notes
O = Outline
NO = No Outline

Table 3

Results of Tukey's HSD Tests at .01 Level

Notes x Outline Interaction

Variables	Outline		No Outline	
	$\bar{X}_1$ Notes	$\bar{X}_2$ No Notes	$\bar{X}_1$ Notes	$\bar{X}_2$ No Notes
DRH	3.84		11.4*	
DRL	1.10		2.1	
IRH	.72		16.34*	
IRL	.10		12.52*	

FIGURE 1

Notes X Outline Interaction
Means Collapsed Across Traditional and Spaced Lectures
Four Dependent Variables

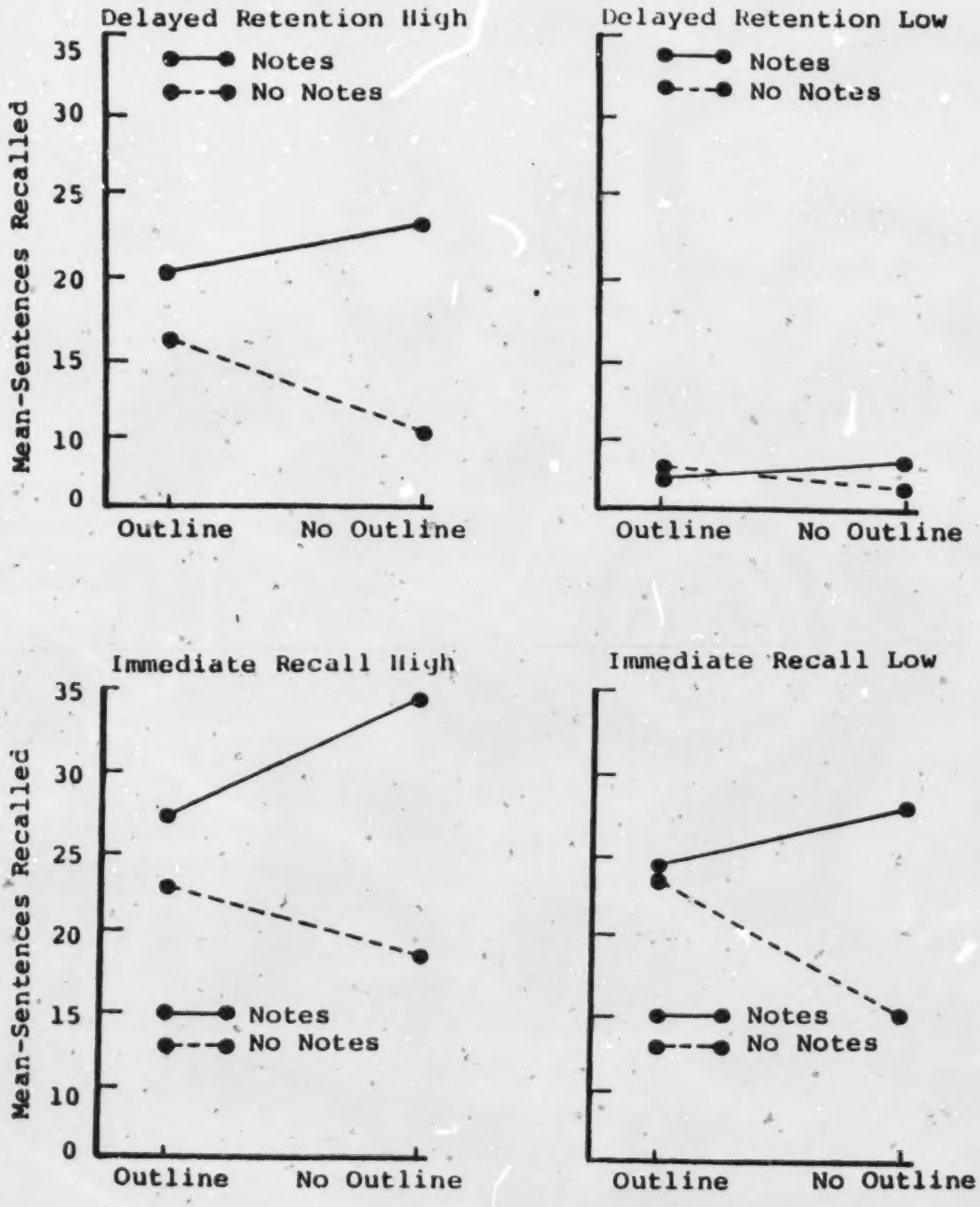

FIGURE 2

Lecture X Notes X Outline Interaction
Traditional Lecture (TL) - Spaced Lecture (SL)
Delayed Retention High (DRH) - Immediate Recall Low (IRL)

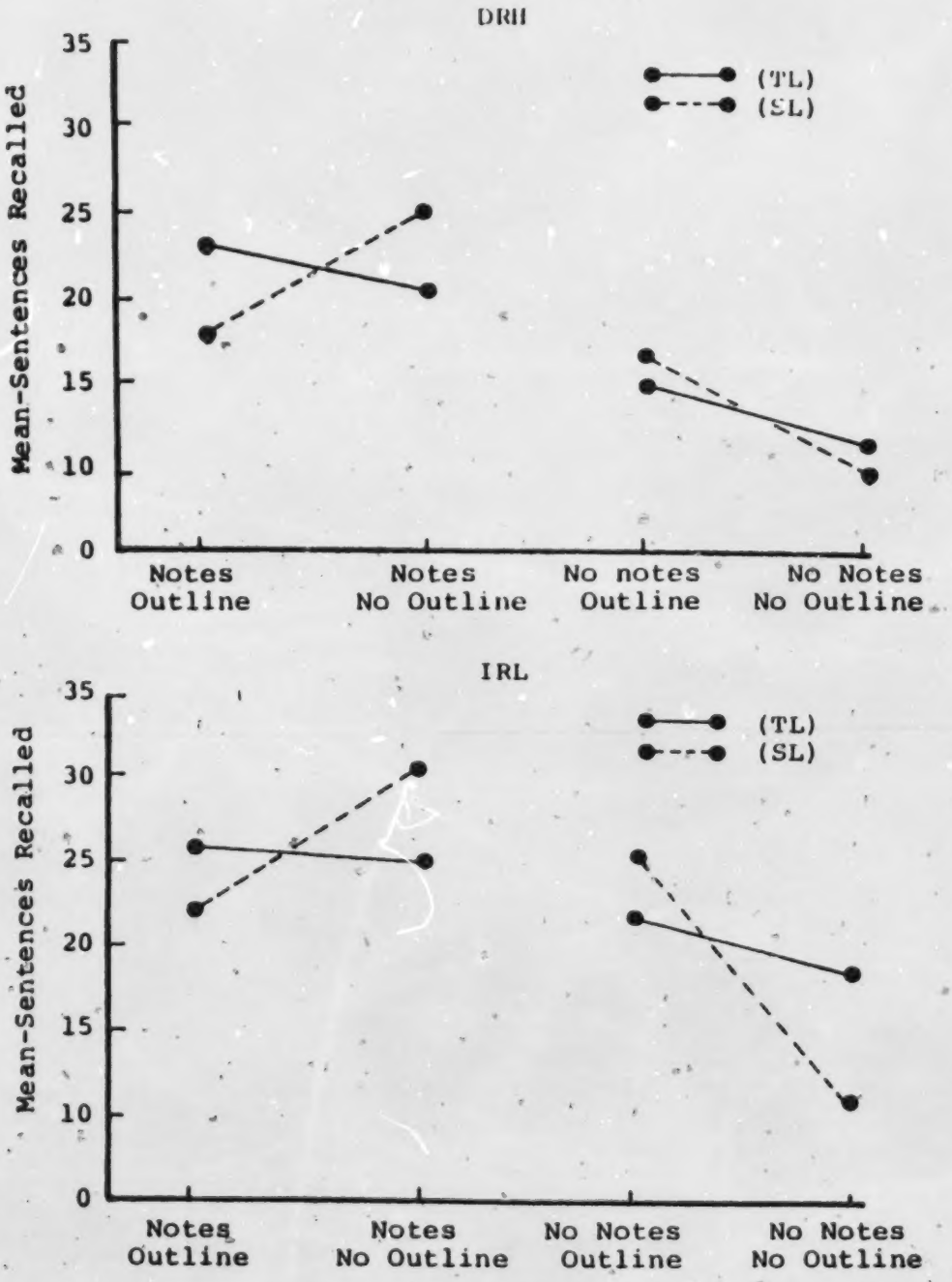

Table 4

Tukey's Honestly Significant Difference Test--Lecture x Notes x Outline Interaction

Delayed Retention High (DRH) - Immediate Recall Low (IRL)

Treatment Condition		2	3	4	5	6	7	8	Dep. Var.	$\bar{X}$
SL N O	1	7.6	.56	6.8	5.44	3.04	2.24	5.36	DRH	18.00
		7.48*	3.44	10.16*	4.08	7.88	.40	4.16	IRL	22.48
SL N NO	2		8.16	14.40*	2.16	4.56	9.84*	2.92	DRH	25.60
			4.40	18.00*	3.56	4.96*	7.44*	12.00*	IRL	30.32
SL NN O	3			6.24	6.00	3.60	1.68	4.80	DRH	17.44
				13.60*	.64	.56	3.04	7.60*	IRL	25.92
SL NN NO	4				12.24*	9.84*	4.56	1.44	DRH	11.20
					14.24*	3.04	10.56*	6.00*	IRL	12.32
TL N O	5					2.40	7.68	10.80*	DRH	23.44
						1.20	3.68	8.24*	IRL	25.56
TL N NO	6						5.28	8.40	DRH	21.04
							6.48	7.04*	IRL	25.36
TL NN O	7							3.12	DRH	15.76
								4.56	IRL	22.88
TL NN NO	8									12.64
										18.32

SL = Spaced Lecture; TL = Traditional Lecture; N = Notes; NN = No Notes; O = Outline; NO = No Outline; * = Significant Means Differences

Table 5

Means and Standard Deviations for Two Covariates

SAT (Verbal) and SAT (Quantitative)

Treatment	SAT(V)	SD	SAT(Q)	SD
SL, N, O	403.62	95.08	412.00	116.08
SL, N, NO	440.00	85.00	422.80	75.74
SL, NN, O	437.60	89.54	427.60	87.33
SL, NN, NO	390.00	66.08	415.60	75.66
TL, N, O	392.80	57.62	382.00	71.64
TL, N, NO	412.80	93.47	432.00	80.20
TL, NN, O	384.40	83.32	373.60	88.54
TL, NN, NO	376.00	76.27	392.80	79.34

INTERCORRELATION MATRIX FOR FOUR DEPENDENT VARIABLES

STANDARD DEVIATIONS FOR THE COVARIATE

ON THE DIAGONAL

Variable	DRH	DRL	IRH	IRL
DRH	8.380			
DRL	.494	4.072		
IRH	.930	.694	11.109	
IRL	.653	.339	.614	8.363

INTERCORRELATION MATRIX FOR FOUR DEPENDENT VARIABLES

STANDARD DEVIATIONS FOR THE COVARIATE

ON THE DIAGONAL

Variable	DRH	DRL	IRH	IRL
DRH	8.380			
DRL	.494	4.072		
IRH	.930	.694	11.109	
IRL	.653	.339	.614	8.363